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(54) Color temperature and illumination adjusting system, and method thereof

Farbtemperatur und Beleuchtungseinstellsystem und Verfahren dafür

Température de couleur, système de réglage d'éclairage et procédé associé

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Description

TECHNICAL FIELD

[0001] The invention relates to color temperature and illumination adjusting systems, and more particularly to color temperature and illumination adjusting systems controlling the pulse width modulation.

BACKGROUND

[0002] The conventional adjustment of the illumination and the color temperature of light-emitting diode (LED) lights is generally performed based on a simple linear correlation between a duty cycle of Pulse Width Modulation (PWM) and the illumination. However, due to LEDs having different characteristics at different temperatures or using different circuit arrangements, the correlation between the LED's illumination/color temperature and the duty cycle may not be a simple linear correlation, so that using the conventional manner of adjustment makes it difficult to accurately output light source corresponding to illumination. Furthermore, the light source apparatus uses an internal micro-controller to operate the calculation of the pulse modulation, but it is limited by the performance of the internal micro-controller, so that it is difficult to generate an accurate calculation result. If the conventional light source apparatus must perform a more complicated calculation, the reaction of the light source apparatus may decrease.

[0003] WO 2007/023454 A1 relates to controlling light emitting diodes (LEDs) for creating a white light backlight such as for liquid crystal displays (LCDs). The LEDs described therein can store optimal current settings for strings of LEDs, such that color and brightness uniformity in the backlight application is ensured.

[0004] US 2005/0253533 A1 is directed to methods and apparatus for providing power to devices on AC power circuits and in particular to LED based devices, primarily for illumination purposes.

[0005] US 2008/0180414 A1 relates to the control of LEDs and provides a driver architecture for driving an array of e.g. red, blue, green or white LEDs arranged into a plurality of regional arrays having one or more common LED operational parameters such as the same bin values for color, brightness, and/or forward voltage.

[0006] US 2008/0111502 A1 relates to a backlight assembly and a method of driving the same having a function of a local dimming to realize a high luminance image.

[0007] US 8,040,075 B2 relates to the adjustment of a color temperature and brightness of an illumination apparatus, in accordance with the preamble of claims 1-4.

SUMMARY

[0008] An embodiment of a temperature and illumination adjusting system comprises a temperature and illumination adjusting device and a lamp device. The temperature and illumination adjusting device comprises a central processing unit, a memory unit, and a communication unit. The central processing unit receives an illumination value and a color-temperature value, and generates a first PWM value and a second PWM value according to a first formula and a second formula. The memory unit stores the first formula and the second formula, wherein the first formula indicates the correlation between the first PWM value, the second PWM value and the illumination value, and wherein the second formula indicates the correlation between the first PWM value, the second PWM value and the color-temperature value. The communication unit outputs the first PWM value and the second PWM value. The lamp device comprises a lamp communication unit, a first PWM driving unit, a second PWM driving unit, a first light module, and a second light module. The lamp communication unit receives the first PWM value and the second PWM value. The first PWM driving unit drives the first light module by the first PWM value, and the second PWM driving unit drives the second light module by the second PWM value. The outputs of the first light module and the second light module have different color temperatures.

[0009] An embodiment of a temperature and illumination adjusting method comprises: obtaining an illumination value and a color-temperature value; generating a first PWM value and a second PWM value according to a first formula and a second formula, wherein the first formula indicates the correlation between the first PWM value, the second PWM value and the illumination value, and wherein the second formula indicates the correlation between the first PWM value, the second PWM value and the color-temperature value; transmitting the first PWM value and the second PWM value to an external lamp device; driving the first light module of the external lamp device by the first PWM value; and driving the second light module of the external lamp device by the second PWM value, wherein the outputs of the first light module and the second light module have different color temperatures.

BRIEF DESCRIPTION OF DRAWINGS

[0010] The invention will become more fully understood by referring to the following detailed description with reference to the accompanying drawings, wherein:

Fig. 1 is a block diagram illustrating an embodiment of a temperature and illumination adjusting system;
Fig. 2A is an experiment data table showing an embodiment of the PWM values PWM1 and the PWM values PWM2 at different illumination values L;
Fig. 2B is schematic diagram illustrating the correlation between the PWM values PWM1 and the PWM values PWM2 at different illumination values L;
Fig. 2C is schematic diagram illustrating the correlation between the ratios of the PWM value PWM1 to the PWM value PWM2 and different color temper-

atures CCT;

Fig. 2D is schematic diagram illustrating the correlation between the PWM values PWM1 and the PWM values PWM2 at different illumination values L and different color temperatures CCT; and

Fig. 3 is a flowchart of an embodiment of a method for the temperature and illumination adjusting system shown in Fig. 1.

DESCRIPTION OF EMBODIMENTS

[0011] Fig. 1 is a schematic diagram illustrating an embodiment of a temperature and illumination adjusting device 100. The temperature and illumination adjusting device 100 comprises a central processing unit 110, a communication unit 120, and a memory unit 130. A lamp device 200 comprises a lamp communication unit 210, PWM driving units 220 and 222, and light modules 230 and 232, wherein the light module 230 and the light module 232 have different color temperatures. In some embodiments, light modules are light-emitting diodes.

[0012] Because the light module 230 and the light module 232 of the lamp device 200 have different color temperatures, the combination of the light module 230 and the light module 232 with different illuminations can generate mixing lights of different color temperatures and illuminations. Also, the light module 230 and the light module 232 can be driven by different duty cycles of Pulse-Width Modulation to output different illuminations. Therefore, the duty cycles of Pulse-Width Modulation (referred to as PWM value hereafter) PWM1 and PWM2 of the light module 230 and the light module 232 can be set in order to adjust the color temperatures and illuminations of mixing lights.

[0013] In some embodiments, when a user or an application program adjusts the color temperatures CCT and the illuminations L of the lamp device 200, the user can input the color temperatures CCT and the illuminations L to the central processing unit 110 via a user interface UI. When the central processing unit 110 receives the color temperatures CCT and the illuminations L, the central processing unit 110 calculates according to the color temperatures CCT, the illuminations L, and a first formula and a second formula stored in memory unit 130. The first formula indicates the correlation between the first PWM value PWM1, the second PWM value PWM2 and the illumination value L, as follows: PWM2=A(L)+B(L)*PWM1, wherein $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, and a_1, a_2, b_1, b_2 are constants. Note that different specifications of light modules or different combinations of light modules may have different constants a_1, a_2, b_1, and b_2, wherein the constants a_1, a_2, b_1, and b_2 may be obtained by experimentation or nonlinear regression analysis. For example, the experiment data in Fig. 2A can be obtained by experimentation. Next, after data for the combinations of the Pulse-Width Modulation values PWM1 and PWM2 at different illuminations is obtained, an approximation formula of the relationship between the Pulse-Width Modulation values PWM1 and PWM2 under a fixed illumination can be calculated according to the data in Fig. 2A. For example, the data in Fig. 2A may derives five formulas indicating the correlation between the Pulse-Width Modulation values PWM1 and PWM2, and the formulas corresponding to illuminations 2501m, 3501m, 4001m, 5501m, and 6001m, respectively, as follows: PWM2=-1.3829*PWM1+120.39 (600lm); PWM2=-1.4514*PWM1+111.98 (550lm); PWM2=-1.3935*PWM1+89.593 (400lm); PWM2=-1.4091*PWM1+68.818 (350lm); PWM2=-1.5138*PWM1+49.22 (250lm). Also, Fig. 2B shows these formulas illustrated as curves on a coordinate axis. Next, these formulas are substituted into the first formula PWM2=A(L)+B(L)*PWM1, as A(600lm)=-1.3829, B(600lm)= 120.39; A(550lm) =-1.4514, B(550lm)= 111.98; A(400lm)= -1.3935, B(400lm)= 89.593; A(350lm)=-1.4091 , B(350lm)= 68.818; and A(250lm)= -1.5138, B(250lm)= 49.22. Therefore, based on the above data, the approximate formulas A(L)=0.0003L-1.5537 and B(L)=0.2039L-0.5584 can be obtained. Finally, by comparing the formulas A(L)=0.0003L-1.5537 and B(L)=0.2039L-0.5584 with $A(L)=a_1+a_2L$ and $B(L)=b_1+b_2L$, we can determine that the constants a_1, a_2, b_1, b_2 are 0.0003, -1.5537, 0.2039, and -0.5584, respectively. It should be noted that the data recited above is merely for example, and the invention is not limited thereto.

[0014] The second formula indicates the correlation between the PWM value PWM1, the PWM value PWM2 and the color temperatures CCT, as follows: $PWM2/PWM1 = c1*e^{-CCT/c2}+c3$, wherein c_1, c_2, c_3 are constants, and e is a mathematical constant. Note that different specifications of light modules or different combinations of light modules may have different constants c_1, c_2, c_3, wherein the constants c_1, c_2, c_3 may be obtained by experimentation or nonlinear regression analysis. For example, data sets for the ratios of the PWM value PWM1 to the PWM value PWM2 and the corresponding color temperatures CCT can be obtained by conducting experiments, and the formula for the ratios PWM2/PWM1 and the color temperatures CCT may be obtained by nonlinear regression analysis according to the data sets. Next, the constants c_1, c_2, c_3 may be obtained by coefficient comparison between the experiment formula and the second formula, and illustrated as curves on a coordinate axis as shown in Fig. 2C.

[0015] It should be noted that the central processor 110 may substitute the illumination value L and the color temperature CCT into the first formula and the second formula, respectively. Therefore, the two formulas of the PWM value PWM1 and the PWM value PWM2 are obtained, such that the PWM value PWM1 and the PWM value PWM2 can be derived from the formulas. For example, as shown in Fig. 2D, if the illumination value L is 250lm and the color temperature CCT is 4000K, 250lm and 4000K are substituted into the first formula and the second formula, respectively. Therefore, the formulas can indicate the correlation between the PWM value PWM1 and the PWM value PWM2 on isoluminance curve 250lm and the correlation between the PWM value PWM1 and the PWM value PWM2 on isotemperature curve 4000K. Finally, the central processing unit 110 obtains the solution of the two formulas as the PWM value PWM1 and the PWM value PWM2 on intersection point A.

[0016] In order to determine a more accurate correlation between the PWM value PWM1, the PWM value PWM2 and the color temperatures CCT, the second formula can be $PWM2/PWM1=c1*e^{-CCT/c2}+c3*e^{-CCT/c4}+c5$ in some embodiments, wherein c_1, c_2, c_3, c_4, c_5 are constants, and e is a mathematical constant. Similarly, different specifications of light modules or different combinations of light modules may have different constants c_1, c_2, c_3, c_4, c_5, and the constants c_1, c_2, c_3, c_4, c_5 may be obtained by experimentation or nonlinear regression analysis. Also, a plurality of data sets can be obtained by experimentation, and the approximate formula of the ratios PWM2/PWM1 and the color temperatures CCT may be obtained by nonlinear regression analysis according to the data sets. Next, the constants c_1, c_2, c_3, c_4, c_5 may be obtained by coefficient comparison between the experiment formula and the second formula.

[0017] In some embodiments, when the central processing unit 110 has obtained the PWM value PWM1 and the PWM value PWM2, the communication unit 120 transmits the PWM value PWM1 and the PWM value PWM2 to the lamp communication unit 210. Next, the lamp communication unit 210 transmits the PWM value PWM1 and the PWM value PWM2 to the PWM driving unit 220 and the PWM driving unit 222 respectively, and the PWM driving unit 220 and the PWM driving unit 222 drive the light modules 230 and 232 according to the PWM value PWM1 and the PWM value PWM2. Therefore, the mixing light generated by the light modules 230 and 232 matches the color temperature CCT and the illumination value L of the user's request. Furthermore, an adjustment of the color temperature of mixing light under a fixed illumination value, or an adjustment of the illumination value of mixing light under a fixed color temperature can be performed according to the present invention.

[0018] It should be noted that the first formula and the second formula are too complex for the controller of a conventional lamp device to calculate, and the microcontroller of a conventional lamp device is incapable of processing a floating-point calculation, so the result of such a calculation may be inaccurate. Therefore, an embodiment of the invention uses the central processing unit 110 to operate the calculation, and then the central processing unit 110 transmits the PWM value PWM1 and the PWM value PWM2 to the lamp device 200. Next, the lamp device 200 drives the light modules 230 and 232 according to the calculated PWM value PWM1 and the PWM value PWM2 without any further calculations. Accordingly, the reaction speed of the lamp device 200 increases, and the accuracy of controlling the color temperature CCT and the illumination value L is improved.

[0019] Furthermore, in some embodiment of the invention, the central processing unit 110 further adjusts the PWM value PWM1 and the PWM value PWM2 according to the sensed illumination of the human eye, so that the color temperature CCT and the illumination value L sensed by the user may be more correct. In order to output light with accurate color temperature and illumination values, the central processing unit 110 can also adjust the PWM value PWM1 and the PWM value PWM2 according to the temperature of the lamp device 200.

[0020] Fig. 3 is a flowchart of an embodiment of a method for the temperature and illumination adjusting system shown in Fig. 1. In step S302, the central processing unit 110 receives the color temperature CCT and the illumination value L. Next, in step S304, the central processing unit 110 obtains the first formula and the second formula, generates the PWM value PWM1 and the PWM value PWM2 by substituting the color temperature CCT and the illumination value L into the first formula and the second formula. In step S306, the communication unit 120 transmits the PWM value PWM1 and the PWM value PWM2 from the central processing unit 110 to the lamp communication unit 210. In step S308, the lamp communication unit 210 transmits the PWM value PWM1 and the PWM value PWM2 to the PWM driving units 220 and 222. Finally, the PWM driving units 220 and 222 drive the light modules 230 and 232 according to the PWM value PWM1 and the PWM value PWM2. Therefore, the mixing light generated by the light modules 230 and 232 can match the color temperature CCT and the illumination value L of the user's request.

Claims

1. A temperature and illumination adjusting system, comprising:

    a temperature and illumination adjusting device (100), comprising:

        a central processing unit (110), adapted to receive an illumination value, L, and a color-temperature value, CCT, and adapted to generate a first duty cycle value of pulse width modulation PWM1 and a second duty cycle value of pulse width modulation PWM2 according to a first formula and a second formula;

    a memory unit (130), adapted to store the first formula and the second formula.
    a communication unit (120), adapted to output PWM1 and PWM2; and
    a lamp device (200), comprising:

a lamp communication unit (210), adapted to receive PWM1 and PWM2;
a first light module (230);
a second light module (232);
a first PWM driving unit (220), adapted to receive PWM1 from the lamp communication unit (210) and to drive the first light module (230) by pulse width modulation having a duty cycle according to PWM1 and
a second PWM driving unit (222), adapted to receive PWM2 from the lamp communication unit (210) and to drive the second light module (232) by pulse width modulation having a duty cycle according to PWM2.

wherein the outputs of the first light module and the second light module have different color temperatures, **characterized in that**
the first formula indicates the correlation between PWM1, PWM2 and the illumination value L; the second formula indicates the correlation between PWM1, PWM2 and the color-temperature value CCT;
whein the first formula is

$$PWM2=A(L)+B(L)*PWM1,$$

and wherein $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, and a_1, a_2, b_1, b_2 are constants; and the second formula is $PWM2/PWM1=c_1*e^{-CCT/c2}+c_3$. and wherein c1, c2, c3 are constants and e is a mathematical constant.

2. A temperature and illuminating adjusting system, comprising:

a temperature and illuminating adjusting device, comprising:

a central processing unit (110), adapted to receive an illumination value, L, and a color-temperature value, CCT, and adapted to generate a first duty cycle value of pulse width modulation PWM1 and a second duty cycle value of pulse width modulation PWM2 according to a first formula and a second formula:

a memory unit (130), adapted to store the first formula and the second formula, and
a communication unit (120), adapted to output PWM1 and PWM2; and a lamp device (200), comprising:
a lamp communication unit (210), adapted to receive PWM1 and PWM2;
a first light module (230);
a second light module (232);
a first PWM driving unit (220), adapted to receive PWM1 from the lamp communication unit (210) and to drive the first light module (230) by pulse width modulation having a duty cycle according to PWM1; and
a second PWM diving unit (222), adapted to receive PWM2 from the lamp communication unit (210) and to drive the second light module (232) by pulse width modulation having a duty cycle according to PWM;2.

wherein the outputs of the first light module and the second light module have different

color temperatures, **characterized in that** the first formula indicates the correlation between PWM1, PWM2 and the illumination value L; the second formula indicates the correlation between PWM1, PWM2 and the color-temperature value CCT;

wherein the first formula is

$$PWM2=A(L)+B(L)*PWM1,$$

and wherein $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, a_1, a_2, b_1, b_2 are constants; and the second formula is $PWM2/PWM1=c_1*e^{-CCT/2}+c_3*e^{-CCT/c4}+c_5$, and wherein c_1, c_2, c_3, c_4, c_5 are constants, and e is a mathematical constant.

3. A temperature and illumination control method, comprising:

obtaining an illumination value, L, and a color-temperature value, CCT; generating a, first duty cycle value of pulse width modulation PWM1 and a second duty cycle value of pulse width modulation PWM2 according to a first formula and a second formula;
transmitting PWM1 and PWM2 to an external lamp device (200);
driving a first light module (230) of the external lamp device (200) by pulse width modulation having a duty cycle according to PWM1 and
driving a second light module (232) of the external lamp device (200) by pulse width modulation having a duty cycle according to PWM2,

wherein the outputs of the first light module (230) and the second light module (232) have different color temperatures, **characterized in that**
the first formula indicates the correlation between PWM1, PWM2 and the illumination value L; the second formula indicates the correlation between

PWM1, PWM2 and the color-temperature value CCT;
wherein the first formula is PWM2=A(L)+B(L)*PWM1, and wherein $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, and a_1, a_2, b_1, b_2 are constants, and the second formula is PWM2/PWM1 $=c_1*e^{-CCT/c2}+c_3$ and wherein c_1, c_2. c_3 are constants and e is a mathematical constant.

4. A temperature and illumination adjusting method, comprising:

obtaining an illumination value, L, and a color temperature value, CCT;
generating a first duty cycle value of pulse width modulation PWM1 and a second duty cycle value of pulse width modulation PWM2 according to a first formula and a second formula,
transmitting PWM1 and PWM2 to an external lamp device (200); pulse driving a first light module (230) of the external lamp device (200) by pulse width modulation having a duty cycle according to PWM1; and
driving a second light module (232) of the external lamp device (200) by pulse width modulation having a duty cycle according to PWM2,

wherein the outputs of the first light module (230) and the second light module (232) have different color temperatures, **characterized in that**
the first formula indicates the correlation between PWM1, PWM2 and the illumination value L; the second formula indicates the correlation between PWM1, PWM2 and the color-temperature value CCT;
wherein the first formula is
PWM2=A(L)+B(L)*PWM1, and wherein $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, a_1, a_2, b_1, b_2 are constants and the second formula is $PWM2/PWM1=c_1*e^{-CCT/c2}+c_3*e^{-CCT/c4}+c_5$, and wherein c_1, c_2, c_3, c_4, c_5 are constants, and e is a mathematical constant.

Patentansprüche

1. Temperatur- und Beleuchtungseinstellungssystem, mit:

einer Temperatur- und Beleuchtungseinstellungsvorrichtung (100) mit:

einer Zentraleinheit (110), die dazu geeignet ist, eine Beleuchtungsstärke L und einen Farbtemperaturwert CCT zu empfangen, und dazu geeignet ist, einen ersten Tastgradwert PWM1 für eine Pulsbreitenmodulation und einen zweiten Tastgradwert PWM2 für eine Pulsbreitenmodulation gemäß einer ersten Formel und einer zweiten Formel zu erzeugen;

einer Speichereinheit (130), die dazu geeignet ist, die erste Formel und die zweite Formel zu speichern;
einer Kommunikationseinheit (120), die dazu geeignet ist, die Werte PWM1 und PWM2 auszugeben; und
einer Lampeneinrichtung (200) mit:

einer Lampenkommunikationseinheit (210), die dazu geeignet ist, die Werte PWM1 und PWM2 zu empfangen;
einem ersten Lichtmodul (230);
einem zweiten Lichtmodul (232);
einer ersten PWM-Treibereinheit (220), die dazu geeignet ist, den Wert PWM1 von der Lampenkommunikationseinheit (210) zu empfangen und das erste Lichtmodul (230) durch eine Pulsbreitenmodulation mit einem Tastgrad gemäß dem Wert PWM1 anzusteuern; und
einer zweiten PWM-Treibereinheit (222), die dazu geeignet ist, den Wert PWM2 von der Lampenkommunikationseinheit (210) zu empfangen und das zweite Lichtmodul (232) durch eine Pulsbreitenmodulation mit einem Tastgrad gemäß dem Wert PWM1 anzusteuern,

wobei die Ausgaben des ersten Lichtmoduls und des zweiten Lichtmoduls verschiedene Farbtemperaturen haben;
dadurch gekennzeichnet, dass
die erste Formel die Korrelation zwischen PWM1, PWM2 und der Beleuchtungsstärke L anzeigt und die zweite Formel die Korrelation zwischen PWM1, PWM2 und dem Farbtemperaturwert CCT anzeigt, wobei die erste Formel lautet:

$$PWM2 = A(L)+B(L)\cdot PWM1,$$

wobei $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$ ist und a_1, a_2, b_1 und b_2 Konstanten sind; und
die zweite Formel lautet:

$PWM2/PWM1 = c_1\cdot e^{-CCT/C2}+c_3$, wobei c_1, c_2 und c_3 Konstanten sind und e eine mathematische Konstante ist.

2. Temperatur und Beleuchtungseinstellungssystem mit:

einer Temperatur- und Beleuchtungseinstellungsvorrichtung mit:

einer Zentraleinheit (110), die dazu geeignet ist, eine Beleuchtungsstärke L und einen Farbtemperaturwert CCT zu empfangen, und dazu geeignet ist, einen ersten Tastgradwert PWM1 für eine Pulsbreitenmodulation und einen zweiten Tastgradwert PWM2 für eine Pulsbreitenmodulation gemäß einer ersten Formel und einer zweiten Formel zu erzeugen;

einer Speichereinheit (130), die dazu geeignet ist, die erste Formel und die zweite Formel zu speichern;
einer Kommunikationseinheit (120), die dazu geeignet ist, die Werte PWM1 und PWM2 auszugeben; und
einer Lampeneinrichtung (200) mit:

einer Lampenkommunikationseinheit (210), die dazu geeignet ist, die Werte PWM1 und PWM2 zu empfangen;
einem ersten Lichtmodul (230);
einem zweiten Lichtmodul (232);
einer ersten PWM-Treibereinheit (220), die dazu geeignet ist, den Wert PWM1 von der Lampenkommunikationseinheit (210) zu empfangen und das erste Lichtmodul (230) durch eine Pulsbreitenmodulation mit einem Tastgrad gemäß dem Wert PWM1 anzusteuern; und
einer zweiten PWM-Treibereinheit (222), die dazu geeignet ist, den Wert PWM2 von der Lampenkommunikationseinheit (210) zu empfangen und das zweite Lichtmodul (232) durch eine Pulsbreitenmodulation mit einem Tastgrad gemäß dem Wert PWM1 anzusteuern,

wobei die Ausgaben des ersten Lichtmoduls und des zweiten Lichtmoduls verschiedene Farbtemperaturen haben;
dadurch gekennzeichnet, dass
die erste Formel die Korrelation zwischen PWM1, PWM2 und der Beleuchtungsstärke L anzeigt und die zweite Formel die Korrelation zwischen PWM1, PWM2 und dem Farbtemperaturwert CCT anzeigt, wobei die erste Formel lautet:

$$PWM2 = A(L)+B(L)\cdot PWM1,$$

wobei $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$ ist und a_1, a_2, b_1 und b_2 Konstanten sind; und die zweite Formel lautet:

$PWM2/PWM1 = c_1\cdot e^{-CCT/c2}+c_3\cdot e^{-CCT/c4}+c_5$, wobei c_1, c_2, c_3, c_4 und c_5 Konstanten sind und e eine mathematische Konstante ist.

3. Temperatur- und Beleuchtungssteuerungsverfahren, mit den Schritten:

Erhalten einer Beleuchtungsstärke L und eines Farbtemperaturwertes CCT;
Erzeugen eines ersten Tastgradwertes PWM1 für eine Pulsbreitenmodulation und eines zweiten Tastgradwertes PWM2 für eine Pulsbreitenmodulation gemäß einer ersten Formel und einer zweiten Formel;
Übertragen der Werte PWM1 und PWM2 an eine externe Lampeneinrichtung (200);
Ansteuern eines ersten Lichtmoduls (230) der externen Lampeneinrichtung (200) durch eine Pulsbreitenmodulation mit einem ersten Tastgrad gemäß dem Wert PWM1 und Ansteuern eines zweiten Lichtmoduls (232) der externen Lampeneinrichtung (200) durch eine Pulsbreitenmodulation mit einem Tastgrad gemäß dem Wert PWM2,

wobei die Ausgaben des ersten Lichtmoduls (230) und des zweiten Lichtmoduls (232) verschiedene Farbtemperaturen haben;
dadurch gekennzeichnet, dass
die erste Formel die Korrelation zwischen PWM1, PWM2 und dem Beleuchtungsstärke L anzeigt und die zweite Formel die Korrelation zwischen PWM1, PWM2 und dem Farbtemperaturwert CCT anzeigt, wobei die erste Formel lautet:

$$PWM2 = A(L)+B(L)\cdot PWM1,$$

wobei $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$ ist und a_1, a_2, b_1 und b_2 Konstanten sind; und die zweite Formel lautet:

$PWM2/PWM1 = c_1\cdot e^{-CCT/c2}+C_3$, wobei c_1, c_2 und c_3 Konstanten sind und e eine mathematische Konstante ist.

4. Temperatur- und Beleuchtungssteuerungsverfahren, mit den Schritten:

Erhalten einer Beleuchtungsstärke L und eines Farbtemperaturwertes CCT;
Erzeugen eines ersten Tastgradwertes PWM1 für eine Pulsbreitenmodulation und eines zweiten Tastgradwertes PWM2 für eine Pulsbreitenmodulation gemäß einer ersten Formel und einer zweiten Formel;
Übertragen der Werte PWM1 und PWM2 an ei-

ne externe Lampeneinrichtung (200);
Ansteuern eines ersten Lichtmoduls (230) der externen Lampeneinrichtung (200) durch eine Pulsbreitenmodulation mit einem ersten Tastgrad gemäß dem Wert PWM1 und Ansteuern eines zweiten Lichtmoduls (232) der externen Lampeneinrichtung (200) durch eine Pulsbreitenmodulation mit einem Tastgrad gemäß dem Wert PWM2,

wobei die Ausgaben des ersten Lichtmoduls und des zweiten Lichtmoduls verschiedene Farbtemperaturen haben;
dadurch gekennzeichnet, dass
die erste Formel die Korrelation zwischen PWM1, PWM2 und dem Beleuchtungsstärke L anzeigt und die zweite Formel die Korrelation zwischen PWM1, PWM2 und dem Farbtemperaturwert CCT anzeigt, wobei die erste Formel lautet:

$$PWM2 = A(L)+B(L)\cdot PWM1,$$

wobei $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$ ist und a_1, a_2, b_1 und b_2 Konstanten sind; und die zweite Formel lautet:

$PWM2/PWM1 = c_1\cdot e^{-CCT/C2}+c_3\cdot e^{-CCT/c4} +c_5$, wobei c_1, c_2, c_3, c_4 und c_5 Konstanten sind und e eine mathematische Konstante ist.

Revendications

1. Système d'ajustement de température et d'illumination, comprenant :

un dispositif d'ajustement de température et d'illumination (100), comprenant :

une unité de traitement centrale (110), destinée à recevoir une valeur d'illumination, L, et
une valeur de température de couleur, CCT, et destinée à générer une première valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM1 et une deuxième valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM2 selon une première formule et une deuxième formule,
une unité de mémoire (130), destinée à mémoriser la première formule et la deuxième formule,
une unité de communication (120), destinée à fournir en sortie une modulation PWM1 et une modulation PWM2, et

un dispositif de lampe (200), comprenant :

une unité de communication de lampe (210), destinée à recevoir une modulation PWM1 et une modulation PWM2,

un premier module de lumière (230),
un deuxième module de lumière (232),
une première unité d'attaque à modulation PWM (220), destinée à recevoir la modulation PWM1 à partir de l'unité de communication de lampe (210) et pour attaquer le premier module de lumière (230) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM1,
une deuxième unité d'attaque à modulation PWM (222), destinée à recevoir la modulation PWM2 à partir de l'unité de communication de lampe (210) et pour attaquer le deuxième module de lumière (232) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM2,

dans lequel les sorties du premier module de lumière et du deuxième module de lumière ont des températures de couleurs différentes, **caractérisé en ce que**
la première formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur d'illumination L, la deuxième formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur de température de couleur CCT,
dans lequel la première formule est $PWM2=A(L)+B(L)*PWM1$, et dans lequel $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, et a_1, a_2, b_1 et b_2 sont des constantes, et la deuxième formule est $PWM2/PWM1=c_1*e^{-CCT/c2}+c_3$, et dans lequel c_1, c_2 et c_3 sont des constantes et e est une constante mathématique.

2. Système d'ajustement de température et d'illumination, comprenant :

une unité de traitement centrale (110), destinée à recevoir une valeur d'illumination, L, et
une valeur de température de couleur, CCT, et destinée à générer une première valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM1 et une deuxième valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM2 selon une première formule et une deuxième formule,
une unité de mémoire (130), destinée à mémoriser la première formule et la deuxième formule,
une unité de communication (120), destinée à

fournir en sortie une modulation PWM1 et une modulation PWM2, et
un dispositif de lampe (200), comprenant :

une unité de communication de lampe (210), destinée à recevoir une modulation PWM1 et une modulation PWM2,
un premier module de lumière (230),
un deuxième module de lumière (232),
une première unité d'attaque à modulation PWM (220), destinée à recevoir la modulation PWM1 à partir de l'unité de communication de lampe (210) et pour attaquer le premier module de lumière (230) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM1,
une deuxième unité d'attaque à modulation PWM (222), destinée à recevoir la modulation PWM2 à partir de l'unité de communication de lampe (210) et pour attaquer le deuxième module de lumière (232) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM2,

dans lequel les sorties du premier module de lumière et du deuxième module de lumière ont des températures de couleurs différentes, **caractérisé en ce que**
la première formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur d'illumination L, la deuxième formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur de température de couleur CCT, dans lequel la première formule est PWM2=A(L)+B(L)*PWM1, et dans lequel $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, et a_1, a_2, b_1 et b_2 sont des constantes, et
la deuxième formule est $PWM2/PWM1=c_1*e^{-CCT/c2}+c_3*e^{-CCT/c4}+ c_5$ et dans lequel c_1, c_2 c_3, c_4 et c_5 sont des constantes et e est une constante mathématique.

3. Procédé de commande de température et d'illumination, comprenant les étapes consistant à :

obtenir une valeur illumination, L, et une valeur de température de couleur, CCT,
générer une première valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM1 et une deuxième valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM2 selon une première formule et une deuxième formule,
transmettre la modulation PWM1 et la modulation PWM2 à un dispositif de lampe externe (200),
attaquer un premier module de lumière (230) du dispositif de lampe externe (200) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM1 et
attaquer un deuxième module de lumière (232) du dispositif de lampe externe (200) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM2

dans lequel les sorties du premier module de lumière (230) et du deuxième module de lumière (232) ont des températures de couleurs différentes, **caractérisé en ce que**
la première formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur d'illumination L, la deuxième formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur de température de couleur CCT, dans lequel la première formule est PWM2=A(L)+B(L)*PWM1, et dans lequel $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, et a_1, a_2, b_1 et b_2 sont des constantes, et la deuxième formule est $PWM2/PWM1=c_1*e^{-CCT/c2}+c_3$, et dans lequel c_1, c_2 et c_3 sont des constantes et e est une constante mathématique.

4. Procédé d'ajustement de température et d'illumination, comprenant les étapes consistant à :

obtenir une valeur illumination, L, et une valeur de température de couleur, CCT,
générer une première valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM1 et une deuxième valeur de rapport cyclique d'une modulation de largeur d'impulsion PWM2 selon une première formule et une deuxième formule,
transmettre la modulation PWM1 et la modulation PWM2 à un dispositif de lampe externe (200),
attaquer un premier module de lumière (230) du dispositif de lampe externe (200) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM1 et
attaquer un deuxième module de lumière (232) du dispositif de lampe externe (200) par modulation de largeur d'impulsion ayant un rapport cyclique selon la modulation PWM2

dans lequel les sorties du premier module de lumière (230) et du deuxième module de lumière (232) ont des températures de couleurs différentes, **caractérisé en ce que** la première formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur d'illumination L, la deuxième formule indique la corrélation entre la modulation PWM1, la modulation PWM2 et la valeur de température de couleur CCT, dans lequel la première formule est

$$PWM2=A(L)+B(L)*PWM1,$$

et dans lequel $A(L)=a_1+a_2L$, $B(L)=b_1+b_2L$, et a_1, a_2, b_1 et b_2 sont des constantes et la deuxième formule est $PWM2/PWM1=c_1*e^{-CCT/c2}+c_3*e^{-CCT/c4}+c_5$, et dans lequel c_1, c_2 c_3, c_4 et c_5 sont des constantes et e est une constante mathématique.

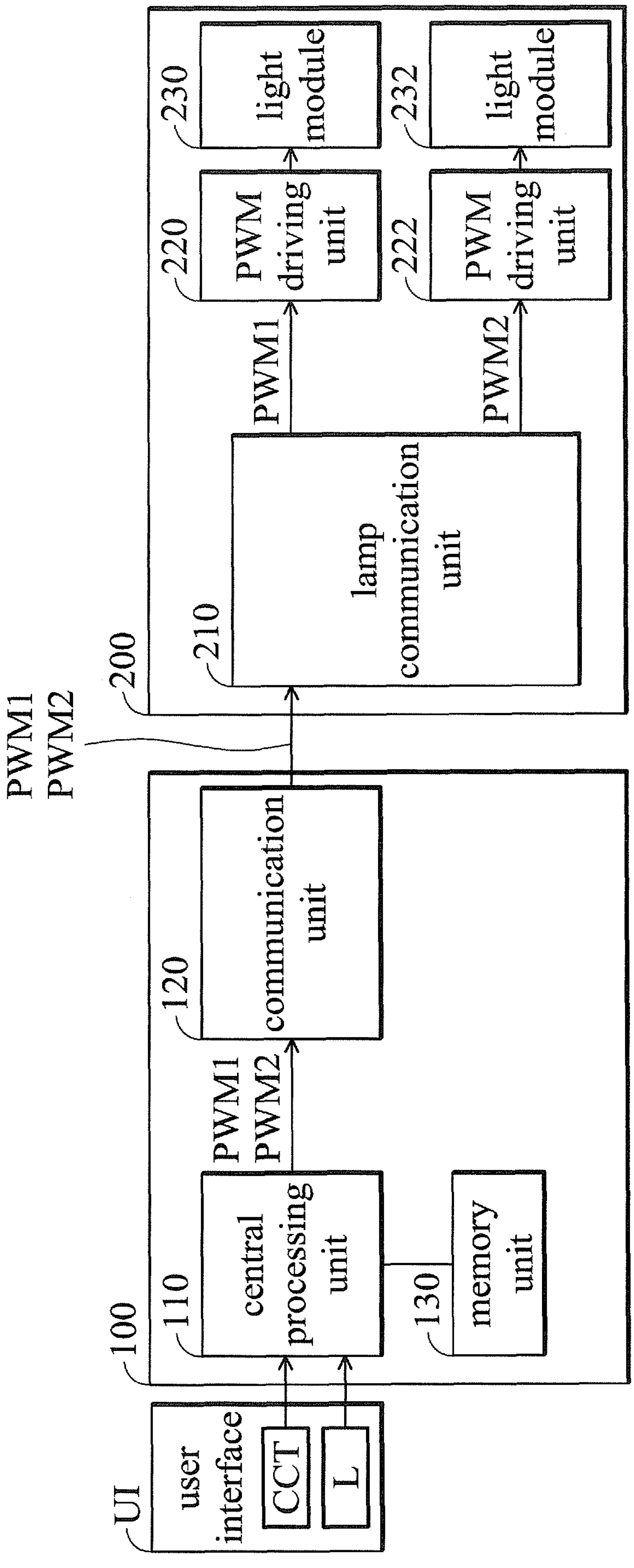

UI
user interface
CCT
L
100
110
central processing unit
130
memory unit
PWM1
PWM2
120
communication unit
PWM1
PWM2
200
210
lamp communication unit
PWM1
PWM2
220
PWM driving unit
222
PWM driving unit
230
light module
232
light module

FIG. 1

Illumination (lm)	600		550		400		350		250	
Pulse Width Modulation Value (%)	PWM1	PWM2	PWM1	PWM2	PWM1	PWM2	PWM1	PWM2	PWM1	PWM2
	80	11	70	11	6	80	6	60	6	40
	70	23	60	25	15	70	13	50	13	30
	60	37	50	39	21	60	21	40	19	20
	50	50	40	53	29	50	28	30	26	10
	40	65	30	68	36	40	35	20		
	30	80	20	84	42	30	41	10		
					50	20				
					57	10				

FIG. 2A

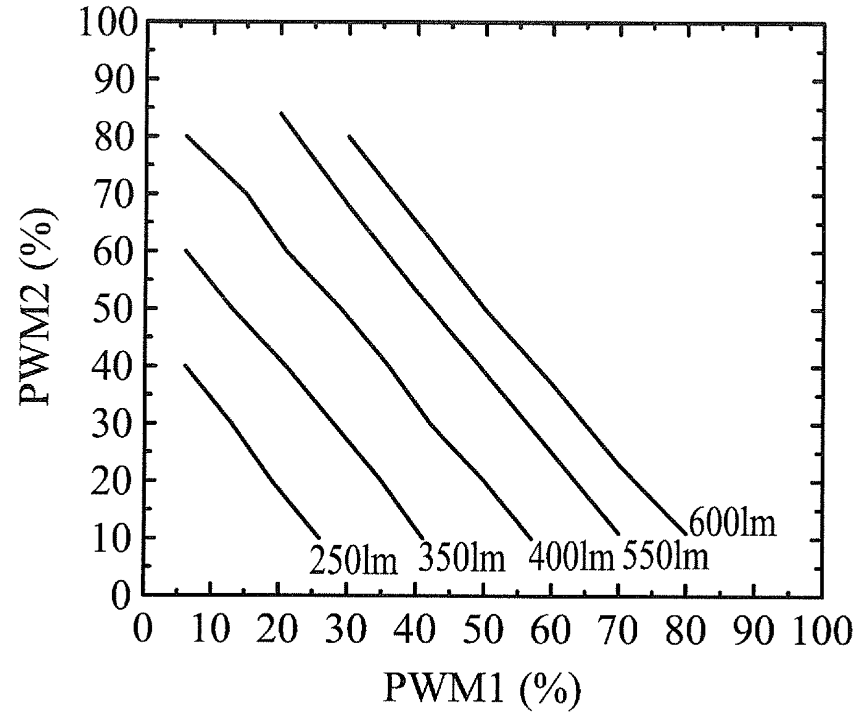

100
90
80
70
60
50
40
30
20
10
0
PWM2 (%)
0 10 20 30 40 50 60 70 80 90 100
PWM1 (%)
250lm
350lm
400lm
550lm
600lm

FIG. 2B

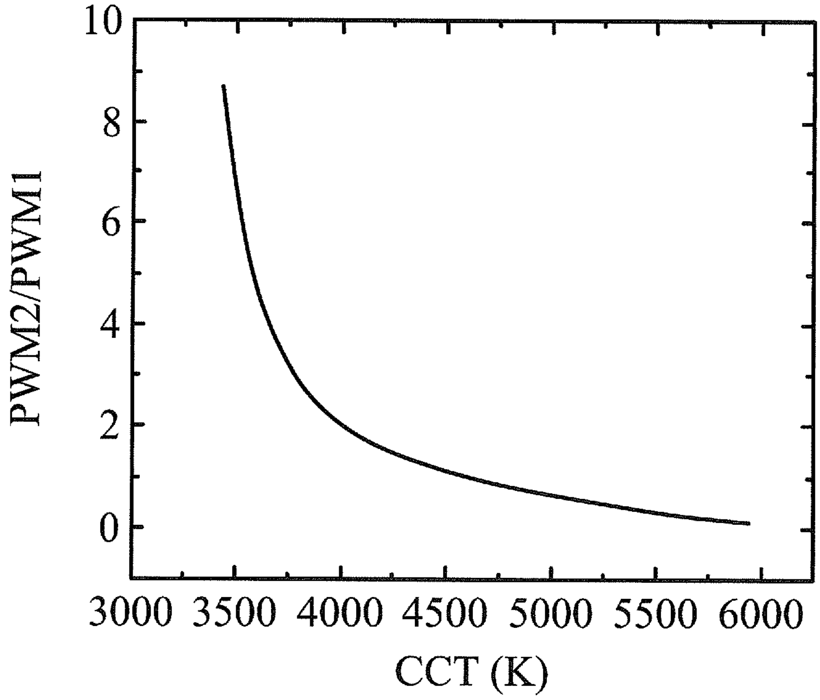
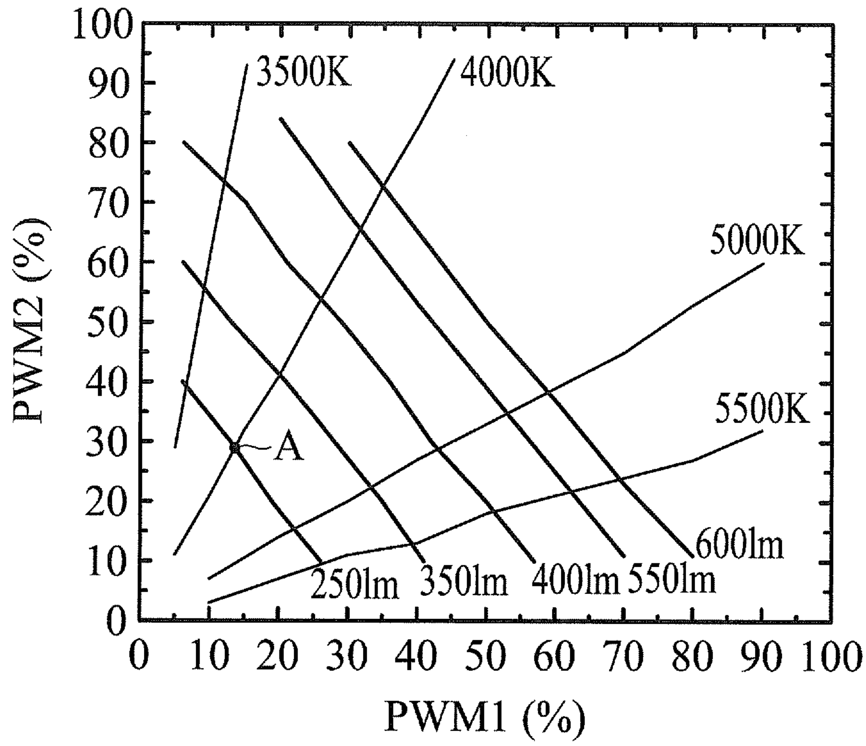

10
8
6
4
2
0
PWM2/PWM1
3000 3500 4000 4500 5000 5500 6000
CCT (K)

FIG. 2C



100
90
80
70
60
50
40
30
20
10
0
PWM2 (%)
3500K
4000K
5000K
5500K
A
250lm
350lm
400lm
550lm
600lm
0 10 20 30 40 50 60 70 80 90 100
PWM1 (%)

FIG. 2D

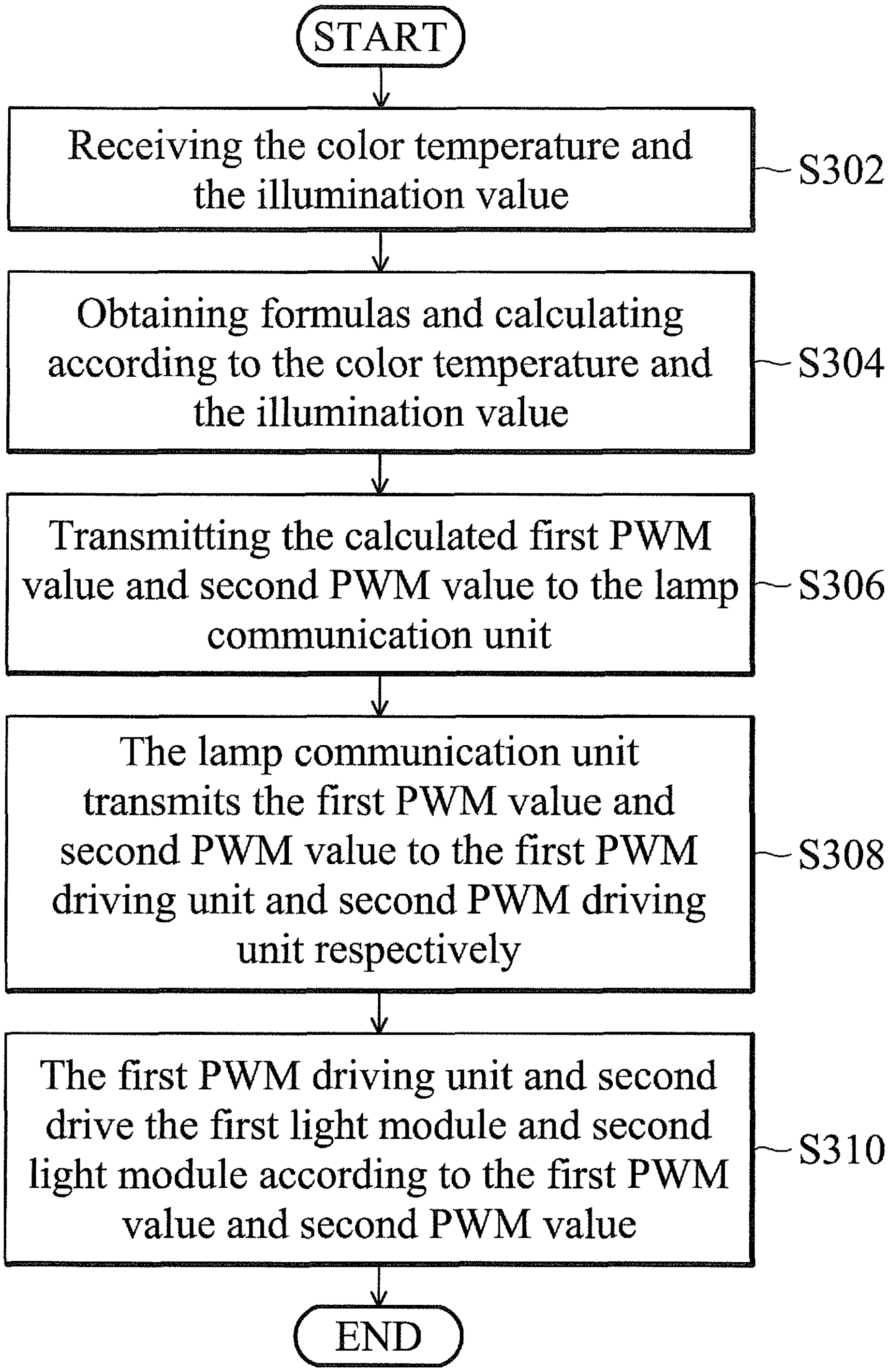

START
Receiving the color temperature and the illumination value
S302
Obtaining formulas and calculating according to the color temperature and the illumination value
S304
Transmitting the calculated first PWM value and second PWM value to the lamp communication unit
S306
The lamp communication unit transmits the first PWM value and second PWM value to the first PWM driving unit and second PWM driving unit respectively
S308
The first PWM driving unit and second drive the first light module and second light module according to the first PWM value and second PWM value
S310
END

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 20050253533 A1 **[0004]**
- US 20080180414 A1 **[0005]**
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- US 8040075 B2 **[0007]**